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An Analysis on the Factors Related to the Adoption of KS Tools

Angela Siew-Hoong Lee, Tong-Ming Lim
Department of Information Systems
Sunway University
Malaysia
angelal@sunway.edu.my, tongmingl@sunway.edu.my

Lip-Sam Thi
School of Business Management
University Utara, Malaysia
thi@uum.edu.my

***Abstract*—KS tools are tools that allow knowledge workers to share and reuse knowledge both in organizations and leisure environments. However the adoption of KS tools in most organizational ecosystem is slow and worrying, as many researchers have pointed out. This study looks into several factors such as nationality, experience, position and education that influence the usage on a list of KS tools. The study will use technology adoption lifecycle proposed by Beal, Rogers and Bohlen [1] model explains the six (6) types of users in organizations. This paper will provide an analysis from data collected to explain the correlations between the factors discussed above and the usage level of the KS tools within their organizations using the theory of diffusion of innovation on different adopter categories [6]. This study uses survey to conduct an empirical investigation and our instruments are designed based on the several past well tested research studies.**

KS tools; knowledge workers; theory of diffusion of innovation; technology adoption

I. INTRODUCTION

To understand one's reasons on accepting or rejecting a particular systems is a challenging issue for most researchers in the information systems field [11]. Many studies had covered the influence of internal beliefs, attitudes of the users and technical design characteristics of the systems. This study will examine factors such as background and education of knowledge workers that influence the adoption of KS tools in term of the amount of usage in their day-to-day works. The characteristics of KS tools play an important role in every knowledge worker. Each knowledge worker has his own priorities and responsibilities in getting the job done and with these tools, they believe that they are able to speed up and increase the productivity of their works. However many knowledge workers are still slacking on the usage of these KS tools. Studies have shown that the adoption level of systems do depend on the usefulness and characteristics of the systems. However, this paper reports the factors that influence the adoption of various types of tools used by knowledge workers.

II. LITERATURE REVIEW

A. Definition of knowledge workers

The revolution of knowledge workers revolves around employees migrating from technical skilled workers to knowledge-based workers. Gone were the days where employees are well needed in industrial automotive works where they are needed to perform structured and routine works, which are manually operated, and heavy labor intensive. Knowledge worker has become an asset for every organization based on intellectual capital [9 ,10]. In today's new economy, many organizations are moving towards economy based knowledge workers. Economy based knowledge workers are to replace industrial mass production workers. The term knowledge worker was first coined and used by Peter Drucker [3] where he predicted that knowledge workers will replace the traditional blue collared employees in 50 years to come [3, 8]. True indeed this has become a reality in many developed countries. Employees who transform themselves to be a knowledge worker are well accepted in the fast moving new economy.

Knowledge workers are workers, which have high degrees of expertise, education and experience in their job. These involve creation, making decision, distribution and application of knowledge into their day-to-day job [2]. Different interpretations of knowledge worker can be found in different literatures:

> Drucker [3] defined knowledge worker as a person who has knowledge and is able to use the knowledge in work. He also stressed that these individuals are referred to as high level employees who apply theoretical and analytical knowledge to develop new innovated products and services. He labeled knowledge worker as a person that is able to acquire, manipulate, interpret and apply information in order to perform multidisciplinary, complex and unpredictable work [3].

> Toffler [12] argued that a knowledge worker is an individual that must possess some forms of technological knowledge and he is able to manage the knowledge among their peers. He refers knowledge worker as a scientist, an engineer and a person who manages technology.

> As for Vinson [13], he described a knowledge worker as somebody who uses their brains more than their hands.

> In 2005, Davenport [2] defined knowledge worker as somebody who obtains good education qualification and

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experience. He also stressed that knowledge worker's job involves knowledge creation, sharing, and applying the knowledge on their day-to-day job operations. Table 1. shows the differences of knowledge work and non-knowledge work and their characteristics.

Table 1: Characteristics of knowledge and non-knowledge workers

Knowledge against Non-Knowledge Work		
Characteristics	Non-Knowledge Work	Knowledge Work
Major Raw Material	material elements	knowledge
Process of Work	obvious	hidden
Work Visibility	high	low
Links to Results	direct and immediate	non direct, effects delayed
Knowledge	concentrated in the hands of managers	diffused in the heads of employees
Power based on	position of the employee in formal and power structures of the organization	profession, knowledge and position of the employee in power structures of the organization
Work is	linear	non linear
Way the employee responds to various situations	based on position and task	employee evaluates the situation and decides the way to respond to it himself
Standards are developed	by others	employee himself
Control is directed to	employee	work and results of work
Performance is measured by	accordance with standards	employee contribution
Role of employee	tool	agent

Hence most knowledge workers have to use technology to perform their work and to help them in their daily work task. Therefore it is crucial to have the right tools to fit the usage of the knowledge workers to enable them to continue be productive in the organization [14, 15].

B. *Types of knowledge sharing tools*

In order for knowledge to be shared, many tools have been developed to ease the sharing process over the years. As knowledge workers in an organization are set to retire or leave the working environment some of these information and knowledge of the organization may lost. Most knowledge sharing tools are designed to capture, retain, share, and collaborate knowledge with other knowledge workers. The knowledge systems could be in a form of websites, conventional systems, wiki, blogs, forums or instant messaging.

The organization should create a safe environment to allow individual to share knowledge. These will encourage the knowledge workers to participate and share their knowledge with other peers. For example, LG Electronics' enterprise knowledge management system was launched in December 2000. The user satisfaction on the access to information issues increased by 63%. This is considered a success of which more than half of the employees in the company are engaged in the system. To improve on knowledge sharing in the organizations, they developed an enterprise knowledge assets management system called Humming Enterprise™ KM and tap into their existing Lotus Notes® to provide employees with a better knowledge sharing tool. LG gives employees easy, precise, and categorized access to all enterprise knowledge created in the many divisions of LG Electronics. It provides not only employees with knowledge, but also collaboration tools such as online conferencing and online chatting, which can improve communication significantly.

C. *Diffusion Theory and Knowledge sharing tools adoption*

In this research, we have adopted the theory of innovation diffusion proposed by Rogers [5]. This theory is a process, which an innovation was created and adopted, hence accepted by the members of a certain community. Although originally the study was based on a study of agricultural innovations, however diffusion theory has been applied successfully in many information technology and information systems area [4]. Rogers's [6] findings highlighted that individuals within a social system do not adopt an innovation at the same time however they adopted through a series of time sequences. He concluded that the innovation usually spread slowly at the beginning and through the encouragement and motivation from internal organization it will then increases its diffusion speed as more and more individual starts to adopt it. Therefore he categorizes the individuals into different adopter categories where each category have a distinct characteristics. The six adopter categories are: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, (5) laggards and (6) leapfroggers. With these categorizations, they allow researchers to analyze the different adoption rates [5]. Below are the definitions of each adopter categories [6, 7]

Table 2: Adopters Category

Adopters category	**Definition**
Innovators	Individual in this category are willing to take risks, having stable financial income, and has high social status.
Early adopters	Individual in this category are technology focuses, willing to take risks, willing to experiment, and they are opinion leadership.
Early Majority	These individual adopt an innovation after a degree of time longer compare to innovators and early adopters. Individuals falls under this category has an average social status, and are pragmatic users.
Late Majority	They adopt the innovation after the average participant. These individual only adopt the innovation after majority of individuals adopted it. They are usually skeptic about an innovation and have below average social status, incomes and little opinion leadership
Laggards	They are the last to adopt an innovation. These individuals tends to focus on "traditions", "oriented" and were the oldest among adopters.
Leapfroggers	These individuals usually skip a few generations in order to reach the most recent technologies.

Ryan and Gross [16] discovered that diffusion was a social process where it was subjected to evaluations of an innovation spread out across from early stage of adopters to later adopters rather than one rational decision making on the adoption of a particular technology. At that time, a new finding of the diffusion processes emphasized on the effect of social factors on technology adoption was also presented by the authors. Diffusion theories can provide a powerful lens for the study of integrating knowledge sharing tools into the ecosystems of knowledge management.

Folorunso *et al.* [17] adopted the theory of diffusion of innovation theory into their study of social networking sites

among the university students. Their study analyzed the issues involving the adoption of social networking sites using the diffusion of innovation theory to test its adoption level among the university students. Five constructs were looked into: relative advantage; complexity; compatibility; observability and trialability to examine their impact on the intention to use it. The results show that relative advantage towards the technology indeed brings influence users' attitude towards intention in use

III. RESEARCH METHODOLOGY

This section focuses on the design of the survey instrument to be used for this study. The items used to construct each variable were adopted from previous studies on technology diffusion. The variables and constructs used in this instrument were designed specifically for this research study.

A. Designed of instrument

Designing questionnaire is the most important stage in research methodology. Inappropriate questionnaire design will lead to wrong research outcomes therefore an ample of time had been located in designing questionnaires. Items used to study each variable are advisable to be adapted from previous studies which are well tested, consistent and reliable. Meanwhile the operational definition for each construct is to be used to develop proper indicators or items for measuring these constructs. In order to operationalize a construct, the level of measurement must be identified. In this research study, some of the rating scales that are commonly used in the social sciences were adopted. In this research, these rating scales are nominal; interval; binary and Likert. Nominal scale was used to measure the two items in this research:

i. Job position
ii. Education level

The reason for choosing this scale is to gather information of the respondents based on their different job positions and education level. It is believed that different positions and education levels will [18, 19] affect the research outcomes of this case study as their views and perspective might be different.

Interval scale was used to measure the working experience of the employees. Selected range of years was identified to differentiate the number of years of working experience of the respondents. Reasons to study the different years of working experience in the organization are as the seniority of a respondent from the organization is relatively important due to the years of experience will determine the different views and perspective towards the organization.

Binary scale was used to gather respondent's technicality background of information. Different types of technical background will determine whether the respondents are tech savvy or not hence the type of KS tools used will be different too.

B. Procedures and sources of data

The research sample includes different types of knowledge workers from various industries who have used some sort of knowledge tools in the organizations. Invitations have been sent out to 500 respondents from a list of 2500 registered Multimedia Super Corridor (MSC) status companies_ to participate in this research study. Overall, of the 500 invitations sent, 296 usable questionnaires were received and used for analysis, giving a response rate of 59.2 percent. Detailed descriptive statistics relating to the respondents' characteristics are shown in the later section. In order to develop and validate the instrument several steps were taken:

1) *development of the instrument from past studies*
2) *pre-test and pilot test of the instrument*

Selected knowledge workers from the different organizations conducted the pre-test and pilot test of the instrument. Five knowledge workers from each of the agreed participating organization were selected to conduct these exercises. Minor refinement on the instrument was done prior to the actual data collected.

IV. FACTORS UNDER INVESTIGATION AND ANALYSIS OF SURVEY RESPONSES

In this study, several factors have been investigated: nationality, company location, position, work experience and education. A list of KS tools and their usage in term of frequency of use is presented to the respondents where respondents are asked to indicate which are the KS tools respondents use to carry out their day-to-day works. Respondents can choose one of these options for each KS tool that they use in their work: very often, often, occasional, seldom and very seldom.

A. Influence of factors and usage of KS tools

In this paper, the following model is examined to study possible correlations and their impacts to the dependent variable, KS tools usage:
KS tools usage = nationality
KS tools usage = job position
KS tools usage = experience
KS tools usage = education

Nationality is measured in term of country where the knowledge workers (or respondents) come from. Location is where the company is situated. It is either a city or town in a country where the company is located. Position is the current job title of the respondent. It is a good indicator of the scope of duty in which the respondent carries out now. His position may cover one or more areas such as technical, management, operational or planning. Work experience is an indicator of the no of years one works in his career. Education indicates his highest academics qualification. It is an indicator that displays his knowledge worker identity.

In this study, distribution analysis of each factor will be presented. This is followed with a correlation analysis of each factor with usage of the KS tool.

B. Analysis of responses

Distribution of respondents is analyzed by country in Figure 1. Figure 1 shows the geographical distribution of the respondents in this case study. Malaysian comprises majority of the respondents and other nationalities hold very little percentage; they are from countries such as USA, Pakistan, India and Indonesia.

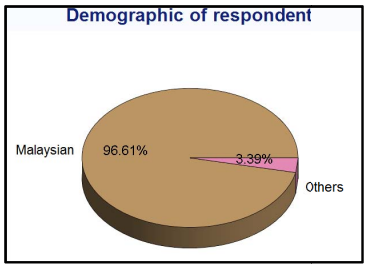

Figure 1. Distribution of respondents of different geographical locations

The respondents were also asked about their education background. Figure 2 shows the respondents' education level. Majority of the respondents have a degree in a specialized course. 73.5% of the respondents have an undergraduate degree; this is followed by respondents with Master degree that takes up about 10.5% and 9.8% of the respondents has diploma certificate. This indicates that most of the knowledge workers are well educated and the knowledge sharing activities in the companies are well led by these graduates. The analysis indicates that 98.64% of the respondents are trained individuals with a minimum of professional certificates and above, hence this shows that education has influence on knowledge sharing practices in the companies.

Variable	Label	Value	Frequency Count	Percent of Total Frequency
Education Level		Degree	217	73.5593
		Master	31	10.5085
		Diploma	29	9.8305
		PhD	8	2.7119
		Professional Certificates	6	2.0339
		SPM	2	0.6780
		Missing	1	0.3390
		STPM	1	0.3390

Figure 2. Distribution of respondents' Education Level

In Figure 3, it shows that a large number of respondents have many years of working experience in the companies. Overall, it is observed that 30.85% of the respondents have more than 10 years of experience. Only 9.15% has less than a year of experience in the companies. Therefore, we can conclude that majority of the knowledge workers in the companies have at least more than one years of working experience in the companies. This implies that majority of the knowledge workers have considerable amount of experience to drive and involve in the knowledge sharing activities in the companies.

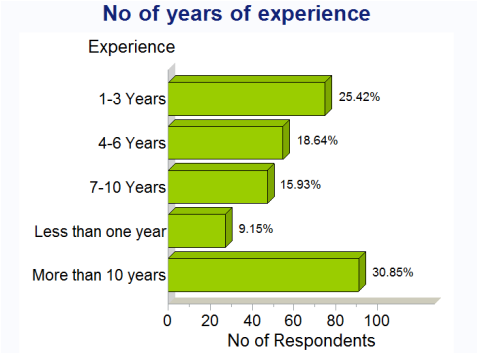

Figure 3. Working experience

Figure 4 shows the respondents' current position in their companies. Majority of the respondents were at the executive level. The remaining groups of the respondents were senior executives and managers in their companies. Since most of the respondents are at the executive, senior executive and manager levels, this indicates that knowledge workers are respondents that are generally more knowledgeable about the operations and management of their companies hence they have deep involvement in knowledge sharing activities with their peers.

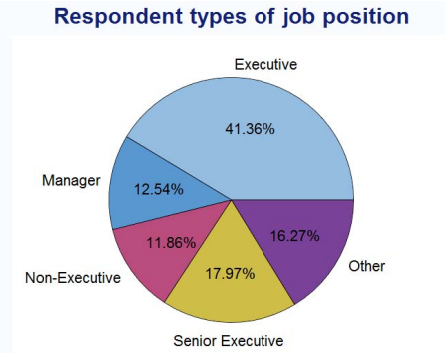

Figure 4. Distribution of position of respondents

Figure 5. shows the correlations between knowledge workers with degree qualification and knowledge sharing tools usage. From the survey, we choose to focus on the group of knowledge workers who are degree holders because they are the largest group of respondents. The knowledge sharing tools used by this group of knowledge workers is analyzed. The survey showed that 180 of the respondents used e-mail followed by 99 respondents use Whatsapp very often. With this analysis we can conclude that majority of the respondents using KS tools were degree holders and they chose email and Whatsapp as their means of communication and knowledge sharing with others in the organizations. We have selected some respondents and interviewed them on the reasons of why they have chosen these two tools. They have commented that it is much easier to use and easy to access to these tools.

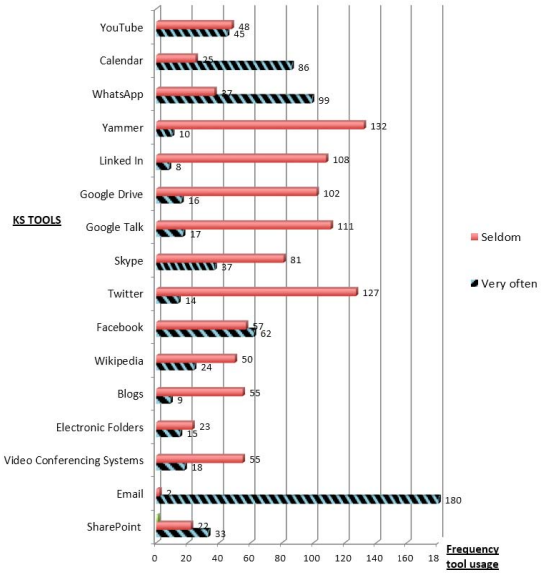

Figure 5. Correlation between degree holders and usage of KS tools.

Figure 6 depicted the correlation between nationalities of the respondents and the usage of KS tools. The respondents' nationalities comprise of Indian, Pakistani, USA, Indonesian, Nigerian, Iranian and Malaysian. Most of the respondents are Malaysians and our analysis has found that Malaysians 'very often' use these KS tools in ascending order: e-mail, Whatsapp, calendar, electronic folder, facebook and YouTube respectively. The KS tools usage frequency is tabulated in Table 3 by different nationalities.

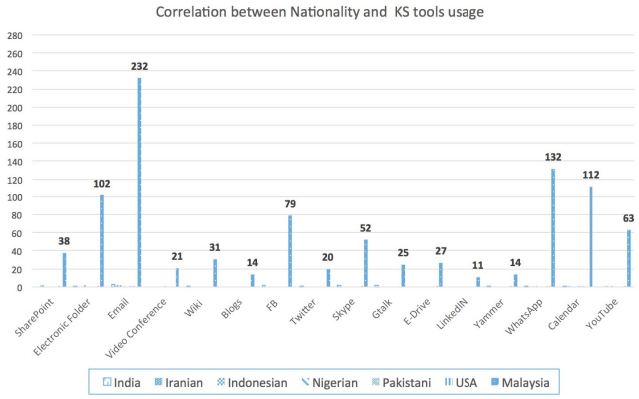

Figure 6. Correlation between different nationalities and usage of KS tools.

Table 3: Number of respondents from different nationality on the usage of different types of KS tool.

Tools/Nationality	India	Iranian	Indonesian	Nigerian	Pakistani	USA	Malaysia
SharePoint	0	2	0	0	0	1	38
Electronic Folder	1	0	2	0	0	1	102
Email	3	2	2	1	1	1	232
Video Conference	0	0	0	1	0	0	21
Wiki	1	0	0	0	0	0	31
Blogs	0	0	0	0	0	0	14
FB	2	0	0	0	0	0	79
Twitter	1	0	0	0	0	0	20
Skype	2	0	0	0	0	1	52
Gtalk	2	0	0	0	0	0	25
E-Drive	0	0	0	0	0	1	27
LinkedIN	0	0	0	0	0	0	11
Yammer	1	0	0	0	0	1	14
WhatsApp	1	0	1	0	0	1	132
Calendar	1	1	0	1	1	0	112
YouTube	0	1	1	0	0	1	63

From years of working experience, knowledge workers who have 'more than 10 years' constitutes the highest group of respondents. Figure 7 shows the correlation between the working experiences and the usage of knowledge sharing tools. The figure focuses on the knowledge workers who have worked more than 10 years as the prime group of respondents to analyze their frequency of KS tools usage. It clearly shows that e-mail, Whatsapp and calendar are the three 'most often' tools by these individuals in their day-to-day works. The analysis shows that the greater their working experience is, they have the tendency to utilize these three tools 'very often' to help them in their knowledge sharing practices.

Figure 7. Correlation between 'executive' and usage of KS tools

Figure 8 depicted the correlation between the position held by the knowledge workers in their jobs and the usage of knowledge sharing tools. The highest respondents in this research study were knowledge workers at the executive level of their current job. Figure 8 illustrates correlations between 'executive' knowledge workers and their KS tools usage. The analysis shows that 103 executives use e-mail as their main form of knowledge sharing tool followed by 55 and 46 respondents using Whatsapp and calendar respectively. The least used tool by these executives was LinkedIn.

Figure 8 shows the correlation between 'executives' knowledge workers and all the KS tools. KS tools such as e-mail, Whatsapp and calendar are tools that are 'very often' used in their daily knowledge sharing activities. In conclusion, the largest group of 'executive' knowledge workers has 'very often' used e-mail, Whatsapp and calander.

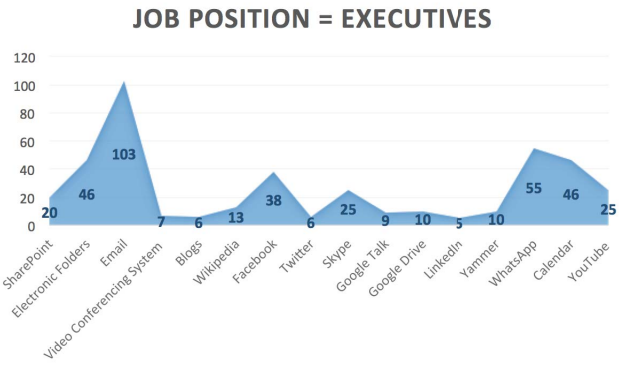

Figure 8. Correlation between different job positions and usage of KS tools

V. CONCLUSIONS

Our analysis confirmed that factors such as nationality, job position, experience, and education level were factors that influence the frequency of usage of the knowledge sharing (KS) tools. By categorizing these respondents to different groups based on education, experience, position in their jobs, and nationalities to deeply understand their frequency of usage on different forms of KS tools, we found that different nationalities, positions of their jobs, years of experience and level of education do influence the level of knowledge sharing tools usage in their companies. In this research, the usage frequency allows us to conclude their level of KS tools adoption. This was accomplished after we conducted a small focus group study followed by the survey we had completed on possible rationale and relationships between frequencies of KS tools usage and their adoption attitude or level. We found that the stage of KS tools adoption is due to respondents found that KS tools are easy to adopt and they are suitable for their jobs. So, those who found KS tools are easy to adopt and they are suitable for their jobs are 'Early adopters' or 'Early Majority' and those who don't find KS tools are easy to adopt and not very suitable for their jobs form either 'Late Majority' or 'Laggards'. This result will need more study in order to generalize.

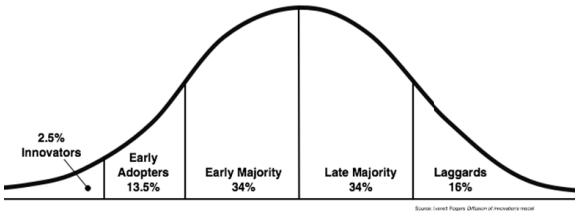

Figure 9. The theory of Diffusion of Innovations

By applying the theory of Diffusion of Innovation (Figure 9), we can conclude that from positions of job, 'executive' knowledge workers are 'Early adopters' From the perspective of years of experience, those who have 'more than 10 years' of working experience falls into 'Early adopters'. The knowledge workers who have a 'degree' make up the largest group of knowledge workers with 'very often' usage frequency. They are also the 'Early adopters' of KS tools. As for nationality, Malaysians knowledge workers are the largest group of respondents in our study and non-Malaysians are too small. Hence, this is a biased sample and will not be considered in our analysis and conclusion.

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